

APPENDIX F

AIR QUALITY

This Appendix details the available data, assumptions and other materials used to develop the construction emissions inventory for select improvements associated with the Easton Airport/Newnam Field (ESN) Environmental Assessment (EA) air quality analysis.

F.1 Construction Activities

For this assessment, construction-related emissions are primarily associated the exhaust from heavy equipment (i.e., backhoes, bulldozers, graders, etc.), delivery trucks (i.e., cement trucks, dump trucks, etc.) and construction worker vehicles getting to and from the site; dust from site preparation, land clearing, material handling, equipment movement on unpaved areas, and demolition activities; and, fugitive emissions from the storage/transfer of raw materials. These emissions are temporary in nature and generally confined to the construction site and the access/egress roadways.

Because a detailed construction equipment listing and activity schedule was not available for the planned improvements at ESN (i.e. the “Proposed Project”), data elements required for the estimation of the associated construction emissions were developed using an equipment list and schedule for similar projects recently planned for the Baltimore-Washington Thurgood Marshall International Airport (BWI) Airport Layout Plan (ALP). The following discussion details the assumptions and methodology used to develop data that would be representative of select improvements associated with the Proposed Project at ESN, including 1) derivation of the construction material and equipment needs and 2) sources of data, including equipment emissions factors, necessary to perform the emissions calculations.

F.1a Development of ESN Construction Equipment List and Schedule

Based on a review of the available BWI-ALP construction schedule, individual BWI projects comparable to those improvements proposed at ESN were selected. Rates of material usage (i.e. square yardage of pavement to be applied per day, cubic yardage of fill material to be processed per day) given the available equipment for the BWI projects, were assessed. Because these specific materials usage rates per project component were available and directly tied to a fleet of equipment at BWI, it was possible to scale these estimates to the total amount of material required to implement the ESN improvements. Specifically, scaled aerial photographs depicting the extent of the planned improvements at ESN were assessed to develop and estimate of square yardage associated with each of the following ESN project elements:

- Construction of Taxiway I
- Extension of Runway 4-22 and Connecting Taxiways
- Construction of Airport Service Road

Documented pavement thicknesses of airfield structures were used to convert the square yardage assumptions described above to cubic yards, where necessary. Specifically, it was assumed that any material laid for the construction of the taxiways, runways and airport service roadways would be at least

28" thick.¹ Subsequently, the materials usage rates and equipment assumptions for BWI were then applied to derive an estimated schedule of workdays required to conduct ESN improvements. **Table F-1** summarizes the material usage rates from the BWI scheduled as applied to the ESN improvement array, as well as the resulting level of scheduled activity estimated for ESN. Additionally, **Table F-2** lists the equipment and equipment attributes that, based on BWI's schedule, would be required for construction at ESN. Importantly, not all ESN projects were directly comparable to the information available from the BWI-ALP, so not all proposed improvements in the ESN array were able to be quantified.

**TABLE F-1
CONSTRUCTION SCHEDULE FOR THE PROPOSED PROJECT**

ESN Construction Project	Material Usage Rates ²		Calculated Materials Demand		2011 Duration (days)
	SY/DAY	CY/DAY	SY	CY	
Taxiway I Construction	750	275 – 750	4,767	3,707	42
Runway 4-22 Extension	750	275 - 750	24,278	18,883	213
Runway 4-22 Extension – Connecting Taxiway #1	750	275 - 750	9,289	7,225	81
Runway 4-22 Extension – Connecting Taxiway #2	750	275 - 750	1,809	1,407	16
Runway 4-22 Extension – Connecting Taxiway #3	750	275 - 750	1,809	1,407	16
Runway 4-22 Extension – Connecting Taxiway #4	750	275 – 750	1,809	1,407	16
Airport Service Road Construction	--	350 - 550	51,383	1,407	187

² Some presented rates are a range because different components of each project (i.e. demolition, milling) were assigned different rates in the BWI schedule.
Sources: KB Environmental Sciences, Inc., and URS Corporation, 2009.

¹ Assumed thickness of airfield pavements derived from the "Supplement to FAA Eastern Region Modification of Airport Design Standards - JFK Airport -- Taxiway Width" dated July 10, 2007.

**TABLE F-2
LIST OF CONSTRUCTION EQUIPMENT**

Equipment	Horsepower¹	Fuel Type
Dump Truck	--	Diesel
Excavator	138	Diesel
Grader	231	Diesel
Milling Machine	9	Gasoline
Paver	135	Diesel
Roller	85	Diesel
Triaxle Truck	--	Diesel

¹ If no horsepower is listed, the equipment is an on-road vehicle and horsepower was not used to estimate emissions.

Source: KB Environmental Sciences, Inc., and URS Corporation, 2009.

F.1b Emissions Data and Calculations

Emissions from construction activities were estimated based on the projected construction activity schedule, the number of vehicles/pieces of equipment, the types of equipment/type of fuel used, vehicle/equipment utilization rates, and the year construction occurs. The emission inventories for off-road (non-highway) equipment were calculated using emission factors obtained from the EPA's NONROAD emissions model (Version 2005), and/or the U.S. EPA Compilation of Air Pollutant Emission Factors (AP-42). Emission factors for on-road (highway) pickup, dump trucks, concrete trucks, employee vehicles, and other on-road regulated vehicles were obtained from the MOBILE6.2 motor vehicle emission model for the year 2011, the assumed year for construction at ESN to occur. To remain conservative, the highest seasonal emission rate (i.e. summer versus winter) was selected and applied to on-road vehicle emissions calculations. [Table F-3](#) presents the emission factors which were used in the analysis.

**TABLE F-3
CONSTRUCTION EQUIPMENT EMISSIONS FACTORS**

Vehicle Class / Description	Fuel Type	2011 Emissions Factor					
		VOC	CO	NOx	SO2	PM10	PM2.5
On-road Motor Vehicles (g/mile) ¹							
Heavy Duty Vehicle, Class 8B	Diesel	0.372	1.331	5.612	0.0151	0.1747	0.1304
Light Duty Vehicle	Gasoline	0.453	4.78	0.377	0.0068	0.0248	0.0113
Off-road Motor Vehicles (g/hp-hr) ²							
Excavator	Diesel	0.278	1.427	3.325	0.750	0.379	0.368
Grader	Diesel	0.252	1.095	3.160	0.724	0.358	0.347
Milling Machine	Gasoline	10.594	673.838	3.359	0.103	0.119	0.109
Paver	Diesel	0.305	1.476	3.692	0.750	0.379	0.368
Roller	Diesel	0.424	3.933	4.360	0.832	0.604	0.586

¹ Emissions factors for on-road vehicles are reported in grams per mile, and represent an assumed speed of 35 mph on arterial roadways.

² Emissions factors for off-road vehicles are reported in grams per horsepower-hour, and represent operation at full throttle conditions.

Source: EPA MOBILE6.2 ; EPA NONROAD 2005.

Emission factors for each equipment type were applied to the anticipated equipment work output (horsepower-hours of expected equipment use). Operating times for the equipment were based on a five-day workweek and an eight-hour workday during which the equipment may be operating.

A load factor accounting for the average throttle setting relative to capacity was applied. For example, a load factor of 0.62 equates to 62 percent of capacity during operation. For the off-road equipment sulfur dioxide and particulate matter emission factors, a diesel sulfur content of 15 parts per million (ultra low sulfur diesel fuel) was assumed, based on EPA mandated regulations effective June 2010.

For on-road vehicles, the anticipated vehicle miles traveled (VMT) were estimated to determine annual emissions. The following equations were used to obtain annual emission rates for off-road equipment and on-road vehicles:

$$\text{Emission Rate (tons/year)} = \text{Emission Factor (g/hp-hr)} * \text{size (hp)} * 8 \text{ hours per day} * \text{days/year} * \text{Load Factor} * (453.59/2000 \text{ tons/g})$$

$$\text{Emission Rate (tons/year)} = \text{Emission Factor (g/mile)} * \text{speed (miles/hour)} * \text{hours per day} * \text{days/year} * (453.59/2000 \text{ tons/g})$$

To estimate emissions associated with on-road motor vehicles including haul trucks and personal employee vehicles, the following assumptions were applied. VMT was calculated assuming 8 round trips per work day for Dump Trucks and 4 round trips per work day for Triaxle Trucks, each travelling thirty miles per round trip. Employee VMT was calculated assuming 40 miles per work day (round trip), two employee vehicles for every piece of equipment listed in the construction schedule, and the scheduled calendar days for each project subtask as reported in the construction schedule. Where applicable, eight hours per day of work was applied to calculations (as above). Finally, MOBILE6.2 emissions factors employed in the analysis are relative to a vehicle speed of 35 miles per hour.

Additionally, the construction emissions inventories for fugitive dust sources were calculated using emission factors within EPA's AP-42 and other publications. Fugitive dust emissions can result from the following activities: grading, moving soil, and digging, loading/unloading of trucks, movement of trucks on unpaved surfaces, and wind erosion of stockpiles. A fugitive dust emission factor of 10 pounds per day per acre disturbed was used. PM_{2.5} was assumed to be 10 percent of PM₁₀ based on AP-42. Erosion control measures and water programs are typically taken to minimize these fugitive dust and particulate emissions. A dust control efficiency of 75 percent due to daily watering and other measures was estimated based on AP-42.

Evaporative VOC emissions associated with the application of hot mix asphalt on areas requiring paving were estimated using raw materials quantities listed in the projected construction schedule, as well as an emission factor of 0.053 tons of VOC per acre of asphalt material laid, following methodology outlined by the National Association of Clean Air Agencies (NACAA, formerly STAPPA-ALAPCO).

A complete listing of the construction emissions associated with the proposed ESN improvements, arranged individual project, is contained in [Table F-4](#).

**TABLE F-4
ESN PROJECT RELATED EMISSIONS**

	2011 Emissions (tons)					
	VOC	CO	NOx	SO ₂	PM ₁₀	PM _{2.5}
Taxiway I						
Off-road Equipment	0.03	0.33	0.30	0.06	0.04	0.04
On-road Equipment	0.15	0.96	1.29	<0.01	0.04	0.03
Asphalt Paving	0.01					
Fugitive Dust					<0.01	<0.01
Subtotal	0.19	1.29	1.59	0.06	0.08	0.07
Runway 4-22 Extension						
Off-road Equipment	0.15	1.68	1.54	0.33	0.18	0.18
On-road Equipment	0.74	4.90	6.58	0.02	0.21	0.15
Asphalt Paving	0.03					
Fugitive Dust					0.10	0.01
Subtotal	0.92	6.58	8.12	0.35	0.49	0.34
Runway 4-22 Connecting Taxiways						
Off-road Equipment	0.09	1.02	0.93	0.19	0.11	0.11
On-road Equipment	0.45	2.97	3.99	0.01	0.13	0.09
Asphalt Paving	0.02					
Fugitive Dust					0.02	<0.01
Subtotal	0.56	3.99	4.92	0.20	0.26	0.20
Airport Service Road						
Off-road Equipment	0.18	1.14	2.05	0.44	0.25	0.24
On-road Equipment	0.65	4.31	5.78	0.02	0.19	0.14
Asphalt Paving	0.06					
Fugitive Dust					0.19	0.02
Subtotal	0.89	5.45	7.83	0.46	0.63	0.40
GRAND TOTAL	2.56	17.31	22.46	1.07	1.46	1.01